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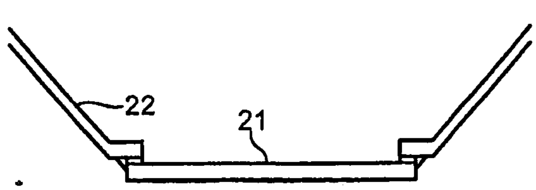
(54) Title: LITHOGRAPHIC APPARATUS AND DEVICE MANUFACTURING METHOD



(57) Abstract: The joint between the lens (21) and its support (22) comprises an inorganic layer or a direct bond and is thus liquid tight which prevents deformation by the immersion liquid. The joint can be made either warm or cold. Solders, glue, and glue protection can all be used in the formation of this joint. The lens (21) and its support (22) are preferably made of quartz.

Lithographic Apparatus and Device Manufacturing Method

FIELD

The present invention relates to a lithographic apparatus and a method for manufacturing a device.

BACKGROUND

A lithographic apparatus is a machine that applies a desired pattern onto a substrate, usually onto a target portion of the substrate. A lithographic apparatus can be used, for example, in the manufacture of integrated circuits (ICs). In that instance, a patterning device, which is alternatively referred to as a mask or a reticle, may be used to generate a circuit pattern to be formed on an individual layer of the IC. This pattern can be transferred onto a target portion (e.g. comprising part of, one, or several dies) on a substrate (e.g. a silicon wafer). Transfer of the pattern is typically via imaging onto a layer of radiation-sensitive material (resist) provided on the substrate. In general, a single substrate will contain a network of adjacent target portions that are successively patterned. Known lithographic apparatus include so-called steppers, in which each target portion is irradiated by exposing an entire pattern onto the target portion at one time, and so-called scanners, in which each target portion is irradiated by scanning the pattern through a radiation beam in a given direction (the "scanning"-direction) while synchronously scanning the substrate parallel or anti-parallel to this direction. It is also possible to transfer the pattern from the patterning device to the substrate by imprinting the pattern onto the substrate.

It has been proposed to immerse the substrate in the lithographic projection apparatus in a liquid having a relatively high refractive index, e.g. water, so as to fill a space between the final element of the projection system and the substrate. The point of this is to enable imaging of smaller features since the exposure radiation will have a shorter wavelength in the liquid. (The effect of the liquid may also be regarded as increasing the effective NA of the system and also increasing the depth of focus.) Other immersion liquids have been proposed, including water with solid

particles (e.g. quartz) suspended therein.

However, submersing the substrate or substrate and substrate table in a bath of liquid (see for example US 4,509,852, hereby incorporated in its entirety by reference) means that there is a large body of liquid that must be accelerated during a scanning exposure. This requires additional or more powerful motors and turbulence in the liquid may lead to undesirable and unpredictable effects.

One of the solutions proposed is for a liquid supply system to provide liquid on only a localized area of the substrate and in between the final element of the projection system and the substrate using a liquid confinement system (the substrate generally has a larger surface area than the final element of the projection system). One way which has been proposed to arrange for this is disclosed in WO 99/49504, hereby incorporated in its entirety by reference. As illustrated in Figures 2 and 3, liquid is supplied by at least one inlet IN onto the substrate, preferably along the direction of movement of the substrate relative to the final element, and is removed by at least one outlet OUT after having passed under the projection system. That is, as the substrate is scanned beneath the element in a –X direction, liquid is supplied at the +X side of the element and taken up at the –X side. Figure 2 shows the arrangement schematically in which liquid is supplied via inlet IN and is taken up on the other side of the element by outlet OUT which is connected to a low pressure source. In the illustration of Figure 2 the liquid is supplied along the direction of movement of the substrate relative to the final element, though this does not need to be the case. Various orientations and numbers of in- and out-lets positioned around the final element are possible, one example is illustrated in Figure 3 in which four sets of an inlet with an outlet on either side are provided in a regular pattern around the final element.

Another solution which has been proposed is to provide the liquid supply system with a seal member which extends along at least a part of a boundary of the space between the final element of the projection system and the substrate table. Such a solution is illustrated in Figure 10. The seal member is substantially stationary relative to the projection system in the XY plane though there may be some relative

movement in the Z direction (in the direction of the optical axis). A seal is formed between the seal member and the surface of the substrate. Preferably the seal is a contactless seal such as a gas seal. Such as system with a gas seal is disclosed in European Patent Application No. 03252955.4 hereby incorporated in its entirety by reference.

In European Patent Application No. 03257072.3 the idea of a twin or dual stage immersion lithography apparatus is disclosed. Such an apparatus is provided with two stages for supporting the substrate. Leveling measurements are carried out with a stage at a first position, without immersion liquid, and exposure is carried out with a stage at a second position, where immersion liquid is present. Alternatively, the apparatus has only one stage.

However, the presence of fluid around the bottom of the projection system has been found to deform the elements concerned leading to degradation of the exposure. The liquid also enters the projection system which can damage or deform delicate parts of the apparatus over time.

US 6,190,778 discloses a method of bonding silicon objects using organic compounds. US 4,983,251 discloses a bonding method without an intermediate layer, called direct bonding, and then annealing. US 5,054,683 describes a method of bonding in which there is a connecting layer containing boron. The two bodies, together with the connecting layer are pressed together and heat treated to bond them.

SUMMARY

It is desirable to provide an apparatus in which distortion of the projection lens due to the presence of liquid is minimized.

According to an aspect of the invention, there is provided a lithographic apparatus comprising:

an illumination system configured to condition a radiation beam;

a support constructed to support a patterning device, the patterning device being capable of imparting the radiation beam with a pattern in its cross-section to form a patterned radiation beam;

a substrate table constructed to hold a substrate; and

a projection system configured to project the patterned radiation beam onto a target portion of the substrate,

The joint is liquid tight - no liquid enters the projection system and deformation of the lens is minimized. In particular, deformation of the final element should be limited to the amount by which lens elements can compensate for the distortion. Direct bonding is used as a broad term and encompasses fusion bonding, anodic bonding, compression bonding etc.

The inorganic layer can be a metal ceramic or glass layer or glue protection. The final element of the projection system and its support are made of glass, bonding of which is relatively simple. In particular the final element and its support are made of fused silica or a glass ceramic Zerodur™ has been found to be particularly suitable.

The apparatus may further comprise a liquid supply system for at least partly filling a space between the final element of the projection system and the substrate with a liquid.

Preferably the joints between all parts of the projection system immersed in liquid comprise an inorganic layer and liquid will therefore not be able to enter the projection system or weaken any of the joints. The joint can be made liquid resistant by applying an inorganic layer to the joint.

The joint can be made without any heating. For example the joint can be made liquid tight by applying a liquid resistant layer to the joint. The joint between the final element of the projection system and its support (and other joints) can be made using glue (which need not be liquid resistant) or by the interaction of physically and chemically clean surfaces. To clean the surfaces a solvent could be applied or the surfaces freshly cleaved. After bonding an inorganic layer could then be applied to the joint.

Alternatively the joint can be heat treated. In particular the joint can be heated to about 900°C, preferably for at least one hour. Again, the joint can be made by the interaction of clean surfaces. For improved results the glass is doped with Boron.

An alternative warm joint is made by the interaction of clean surfaces, sealed with a low temperature glass solder and then heat treated to 600°C. A further type of warm joint is a metal solder. Indium solder has been found to work particularly well.

According to a further aspect of the invention, there is provided a device manufacturing method comprising the steps of:

- providing a substrate;
- providing a projection beam of radiation using an illumination system;
- using patterning means to impart the projection beam with a pattern in its cross-section; and
- projecting the patterned beam of radiation onto a target portion of the substrate,

characterized by making the joint between said final element of said projection system and its support using an inorganic layer or direct bonding.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

Figure 1 depicts a lithographic apparatus according to an embodiment of the invention;

Figures 2 and 3 depict a liquid supply system used in a prior art lithographic projection apparatus;

Figure 4 is a view of a joint according to the invention;

Figure 5 is a detailed view of the joint shown in Figure 4;

Figure 6 is a detailed view of an embodiment of the invention;

Figure 7 is a detailed view of a joint according to an embodiment of the invention;

Figure 8 is a detailed view of a joint according to an embodiment of the invention;

Figure 9 is a detailed view of a joint according to another embodiment of the

invention; and

Figure 10 depicts a liquid supply system according to another prior art lithographic projection apparatus.

DETAILED DESCRIPTION

Figure 1 schematically depicts a lithographic apparatus according to one embodiment of the invention. The apparatus comprises:

- an illumination system (illuminator) IL configured to condition a radiation beam B (e.g. UV radiation or DUV radiation).
- a support structure (e.g. a mask table) MT constructed to support a patterning device (e.g. a mask) MA and connected to a first positioner PM configured to accurately position the patterning device in accordance with certain parameters;
- a substrate table (e.g. a wafer table) WT constructed to hold a substrate (e.g. a resist-coated wafer) W and connected to a second positioner PW configured to accurately position the substrate in accordance with certain parameters; and
- a projection system (e.g. a refractive projection lens system) PS configured to project a pattern imparted to the radiation beam B by patterning device MA onto a target portion C (e.g. comprising one or more dies) of the substrate W.

The illumination system may include various types of optical components, such as refractive, reflective, magnetic, electromagnetic, electrostatic or other types of optical components, or any combination thereof, for directing, shaping, or controlling radiation.

The support structure supports, i.e. bears the weight of, the patterning device. It holds the patterning device in a manner that depends on the orientation of the patterning device, the design of the lithographic apparatus, and other conditions, such as for example whether or not the patterning device is held in a vacuum environment. The support structure can use mechanical, vacuum, electrostatic or other clamping techniques to hold the patterning device. The support structure may be a frame or a table, for example, which may be fixed or movable as required. The support structure may ensure that the patterning device is at a desired position, for example

with respect to the projection system. Any use of the terms "reticle" or "mask" herein may be considered synonymous with the more general term "patterning device."

The term "patterning device" used herein should be broadly interpreted as referring to any device that can be used to impart a radiation beam with a pattern in its cross-section such as to create a pattern in a target portion of the substrate. It should be noted that the pattern imparted to the radiation beam may not exactly correspond to the desired pattern in the target portion of the substrate, for example if the pattern includes phase-shifting features or so called assist features. Generally, the pattern imparted to the radiation beam will correspond to a particular functional layer in a device being created in the target portion, such as an integrated circuit.

The patterning device may be transmissive or reflective. Examples of patterning devices include masks, programmable mirror arrays, and programmable LCD panels. Masks are well known in lithography, and include mask types such as binary, alternating phase-shift, and attenuated phase-shift, as well as various hybrid mask types. An example of a programmable mirror array employs a matrix arrangement of small mirrors, each of which can be individually tilted so as to reflect an incoming radiation beam in different directions. The tilted mirrors impart a pattern in a radiation beam which is reflected by the mirror matrix.

The term "projection system" used herein should be broadly interpreted as encompassing any type of projection system, including refractive, reflective, catadioptric, magnetic, electromagnetic and electrostatic optical systems, or any combination thereof, as appropriate for the exposure radiation being used, or for other factors such as the use of an immersion liquid or the use of a vacuum. Any use of the term "projection lens" herein may be considered as synonymous with the more general term "projection system".

As here depicted, the apparatus is of a transmissive type (e.g. employing a transmissive mask). Alternatively, the apparatus may be of a reflective type (e.g. employing a programmable mirror array of a type as referred to above, or employing a reflective mask).

The lithographic apparatus may be of a type having two (dual stage) or more

substrate tables (and/or two or more mask tables). In such "multiple stage" machines the additional tables may be used in parallel, or preparatory steps may be carried out on one or more tables while one or more other tables are being used for exposure.

Referring to Figure 1, the illuminator IL receives a radiation beam from a radiation source SO. The source and the lithographic apparatus may be separate entities, for example when the source is an excimer laser. In such cases, the source is not considered to form part of the lithographic apparatus and the radiation beam is passed from the source SO to the illuminator IL with the aid of a beam delivery system BD comprising, for example, suitable directing mirrors and/or a beam expander. In other cases the source may be an integral part of the lithographic apparatus, for example when the source is a mercury lamp. The source SO and the illuminator IL, together with the beam delivery system BD if required, may be referred to as a radiation system.

The illuminator IL may comprise an adjuster AD for adjusting the angular intensity distribution of the radiation beam. Generally, at least the outer and/or inner radial extent (commonly referred to as σ-outer and σ-inner, respectively) of the intensity distribution in a pupil plane of the illuminator can be adjusted. In addition, the illuminator IL may comprise various other components, such as an integrator IN and a condenser CO. The illuminator may be used to condition the radiation beam, to have a desired uniformity and intensity distribution in its cross-section.

The radiation beam B is incident on the patterning device (e.g., mask MA), which is held on the support structure (e.g., mask table MT), and is patterned by the patterning device. Having traversed the mask MA, the radiation beam B passes through the projection system PS, which focuses the beam onto a target portion C of the substrate W. With the aid of the second positioner PW and position sensor IF (e.g. an interferometric device, linear encoder or capacitive sensor), the substrate table WT can be moved accurately, e.g. so as to position different target portions C in the path of the radiation beam B. Similarly, the first positioner PM and another position sensor (which is not explicitly depicted in Figure 1) can be used to accurately position the mask MA with respect to the path of the radiation beam B,

e.g. after mechanical retrieval from a mask library, or during a scan. In general, movement of the mask table MT may be realized with the aid of a long-stroke module (coarse positioning) and a short-stroke module (fine positioning), which form part of the first positioner PM. Similarly, movement of the substrate table WT may be realized using a long-stroke module and a short-stroke module, which form part of the second positioner PW. In the case of a stepper (as opposed to a scanner) the mask table MT may be connected to a short-stroke actuator only, or may be fixed. Mask MA and substrate W may be aligned using mask alignment marks M1, M2 and substrate alignment marks P1, P2. Although the substrate alignment marks as illustrated occupy dedicated target portions, they may be located in spaces between target portions (these are known as scribe-lane alignment marks). Similarly, in situations in which more than one die is provided on the mask MA, the mask alignment marks may be located between the dies.

The depicted apparatus could be used in at least one of the following modes:

1. In step mode, the mask table MT and the substrate table WT are kept essentially stationary, while an entire pattern imparted to the radiation beam is projected onto a target portion C at one time (i.e. a single static exposure). The substrate table WT is then shifted in the X and/or Y direction so that a different target portion C can be exposed. In step mode, the maximum size of the exposure field limits the size of the target portion C imaged in a single static exposure.

2. In scan mode, the mask table MT and the substrate table WT are scanned synchronously while a pattern imparted to the radiation beam is projected onto a target portion C (i.e. a single dynamic exposure). The velocity and direction of the substrate table WT relative to the mask table MT may be determined by the (de-)magnification and image reversal characteristics of the projection system PS. In scan mode, the maximum size of the exposure field limits the width (in the non-scanning direction) of the target portion in a single dynamic exposure, whereas the length of the scanning motion determines the height (in the scanning direction) of the target portion.

3. In another mode, the mask table MT is kept essentially stationary holding a

programmable patterning device, and the substrate table WT is moved or scanned while a pattern imparted to the radiation beam is projected onto a target portion C. In this mode, generally a pulsed radiation source is employed and the programmable patterning device is updated as required after each movement of the substrate table WT or in between successive radiation pulses during a scan. This mode of operation can be readily applied to maskless lithography that utilizes programmable patterning device, such as a programmable mirror array of a type as referred to above.

Combinations and/or variations on the above described modes of use or entirely different modes of use may also be employed.

In Figures 4 and 5 the final element, a lens 21, of the projection system is shown together with its support 22. In this example both the lens 21 and the support 22 are made of fused silica but could be made of another glass or any other transparent material. Indeed the lens 21 and the support 22 need not be made of the same material. Ideally, however, their expansion coefficients should be similar. For example a higher quality material may be used for the lens 21 and a lower quality material for the support 22. A glue 23 joins the lens 21 and the support 22 together. Once the glue has set a watertight layer of glue protection 24 is applied to the joint. The glue protection 24 is applied to the entire joint. No parts are left uncovered.

In Figure 6 the surfaces of the lens 21 and the support 22 to be joined have been smoother and physically and chemically cleaned. The surfaces are so clean and smooth that the molecules in the lens 21 and support 22 begin to interact chemically by so-called "direct bonding", forming a bond between the lens and support. To assist and expedite this process the lens 21 and support 22 can be pressed together for a time. This type of bonding is particularly suitable for this situation as it produces minimal distortion of the original materials, maintains the qualities of the original materials and is strong. Additionally, glue sealing 25 can be applied to the joint followed by glue protection 24 covering the entire of the joint area.

The joint can also be made warm. In Figure 7 a bond between the lens and support has been made by joining two physically and chemically clean surfaces, as in Figure 6 and then heat treated at 900°C for at least one hour, preferably at least six

hours. The bonds between the lens 21 and support 22 then become covalent bonds which are particularly strong and watertight, as described in Materials Science Engineering incorporated herein in its entirety. The glass lens 21 and/or support 22 can be covered by a thin layer of Boron prior to the bonding. The Boron diffuses into the glass lens 21 and/or support 22 where it aids bonding of the molecules concerned and reduces local stresses and strains. Annealing can therefore take place at a lower temperature than if Boron were not present and covalent bonds will still be formed. This process is described in more detail in Philips Journal of Research 49 (1995) pages 152-153 incorporated herein in it entirety.

In Figure 8 the joint has been made by bonding two physically and chemically clean surfaces (as in Figures 6 and 7) and then sealed with a low temperature glass solder 27. The glass solder should have the same composition as the lens 21 and the support 22. The joint is then heat treated at about 600°C.

In Figure 9 an indium solder 28 is used between the lens 21 and the support 22. Although indium is a preferred material it will be clear to the skilled user that other metals can also be used.

The joining of lens 21 and support 22, in particular the warm bonding of lens 21 and support 22 preferably occurs in an inert environment to prevent the incorporation contaminants as this would shorten the lifespan of the apparatus. The inert environment may be a vacuum, a clean room or an environment of inert gases.

Although the joint between the lens 21 and its support 22 has been described here it will be obvious to the skilled person that the same technology can be applied to any other joint in the projection system, and indeed in the lithographic apparatus. In particular all joints which may come into contact with the immersion liquid should be made liquid tight by one of the methods described above.

Although specific reference may be made in this text to the use of lithographic apparatus in the manufacture of ICs, it should be understood that the lithographic apparatus described herein may have other applications, such as the manufacture of integrated optical systems, guidance and detection patterns for magnetic domain memories, flat-panel displays, liquid-crystal displays (LCDs), thin-film magnetic

heads, etc. The skilled artisan will appreciate that, in the context of such alternative applications, any use of the terms "wafer" or "die" herein may be considered as synonymous with the more general terms "substrate" or "target portion", respectively. The substrate referred to herein may be processed, before or after exposure, in for example a track (a tool that typically applies a layer of resist to a substrate and develops the exposed resist), a metrology tool and/or an inspection tool. Where applicable, the disclosure herein may be applied to such and other substrate processing tools. Further, the substrate may be processed more than once, for example in order to create a multi-layer IC, so that the term substrate used herein may also refer to a substrate that already contains multiple processed layers.

Although specific reference may have been made above to the use of embodiments of the invention in the context of optical lithography, it will be appreciated that the invention may be used in other applications, for example imprint lithography, and where the context allows, is not limited to optical lithography. In imprint lithography a topography in a patterning device defines the pattern created on a substrate. The topography of the patterning device may be pressed into a layer of resist supplied to the substrate whereupon the resist is cured by applying electromagnetic radiation, heat, pressure or a combination thereof. The patterning device is moved out of the resist leaving a pattern in it after the resist is cured.

The terms "radiation" and "beam" used herein encompass all types of electromagnetic radiation, including ultraviolet (UV) radiation (e.g. having a wavelength of or about 365, 248, 193, 157 or 126 nm) and extreme ultra-violet (EUV) radiation (e.g. having a wavelength in the range of 5-20 nm), as well as particle beams, such as ion beams or electron beams.

The term "lens", where the context allows, may refer to any one or combination of various types of optical components, including refractive, reflective, magnetic, electromagnetic and electrostatic optical components.

While specific embodiments of the invention have been described above, it will be appreciated that the invention may be practiced otherwise than as described. For example, the invention may take the form of a computer program containing one or

more sequences of machine-readable instructions describing a method as disclosed above, or a data storage medium (e.g. semiconductor memory, magnetic or optical disk) having such a computer program stored therein.

The present invention can be applied to any immersion lithography apparatus, in particular, but not exclusively, those types mentioned above.

The descriptions above are intended to be illustrative, not limiting. Thus, it will be apparent to one skilled in the art that modifications may be made to the invention as described without departing from the scope of the claims set out below.

CLAIMS

1. A lithographic apparatus comprising:

an illumination system configured to condition a radiation beam;

a support constructed to support a patterning device, the patterning device being capable of imparting the radiation beam with a pattern in its cross-section to form a patterned radiation beam;

a substrate table constructed to hold a substrate; and

a projection system configured to project the patterned radiation beam onto a target portion of the substrate,

characterized in that the joint between a final element of the projection system and its support comprises an inorganic layer or is a direct bond.

2. A lithographic apparatus according to claim 1, further comprises a liquid supply system for at least partially filling a space between the final element of said projection system and said substrate with a liquid.

3. A lithographic apparatus according to either claim 1 or claim 2, wherein said inorganic layer is a metal, ceramic or glass layer.

4. A lithographic apparatus according to any one the preceding claims, characterized in that said joint was made without heating.

5. A lithographic apparatus according to claim 4, wherein said inorganic layer is glue protection.

6. A lithographic apparatus according to any one of claims 1 to 3, wherein said joint was heat treated.

7. A lithographic apparatus according to claim 6, wherein said joint has been heat treated to 900°C.

8. A lithographic apparatus according to either claim 6 or claim 7, wherein said joint is made by the interaction of clean surfaces.

9. A lithographic apparatus according to any one of claims 6 to 8, wherein said final element of the projection system and its support are doped with Boron.

10. A lithographic apparatus according to either claim 6 or claim 9, wherein said joint is made by the interaction of clean surfaces, sealed with a low temperature glass solder and heat treated to a temperature between 200°C and 600°C.

11. A lithographic apparatus according to any one of claim 6 to 10, wherein said inorganic layer is a metal solder.

12. A lithographic apparatus according to claim 11, wherein said metal solder is Indium..

13. A lithographic apparatus according to any one of the preceding claims, wherein said final element and its support are made of glass.

14. A lithographic apparatus according to claim 13, wherein said final element and its support are made of fused silica or a glass ceramic.

15. A lithographic apparatus according to any one of the preceding claims, wherein the joints between all parts of the projection system immersed in said liquid comprise an inorganic layer.

16. A device manufacturing method comprising the steps of:

- providing a substrate;
- providing a projection beam of radiation using an illumination system;
- using patterning means to impart the projection beam with a pattern in its cross-section; and
- projecting the patterned beam of radiation onto a target portion of the substrate,

characterized by making the joint between said final element of said projection system and its support using an inorganic layer or direct bonding.

Fig. 1

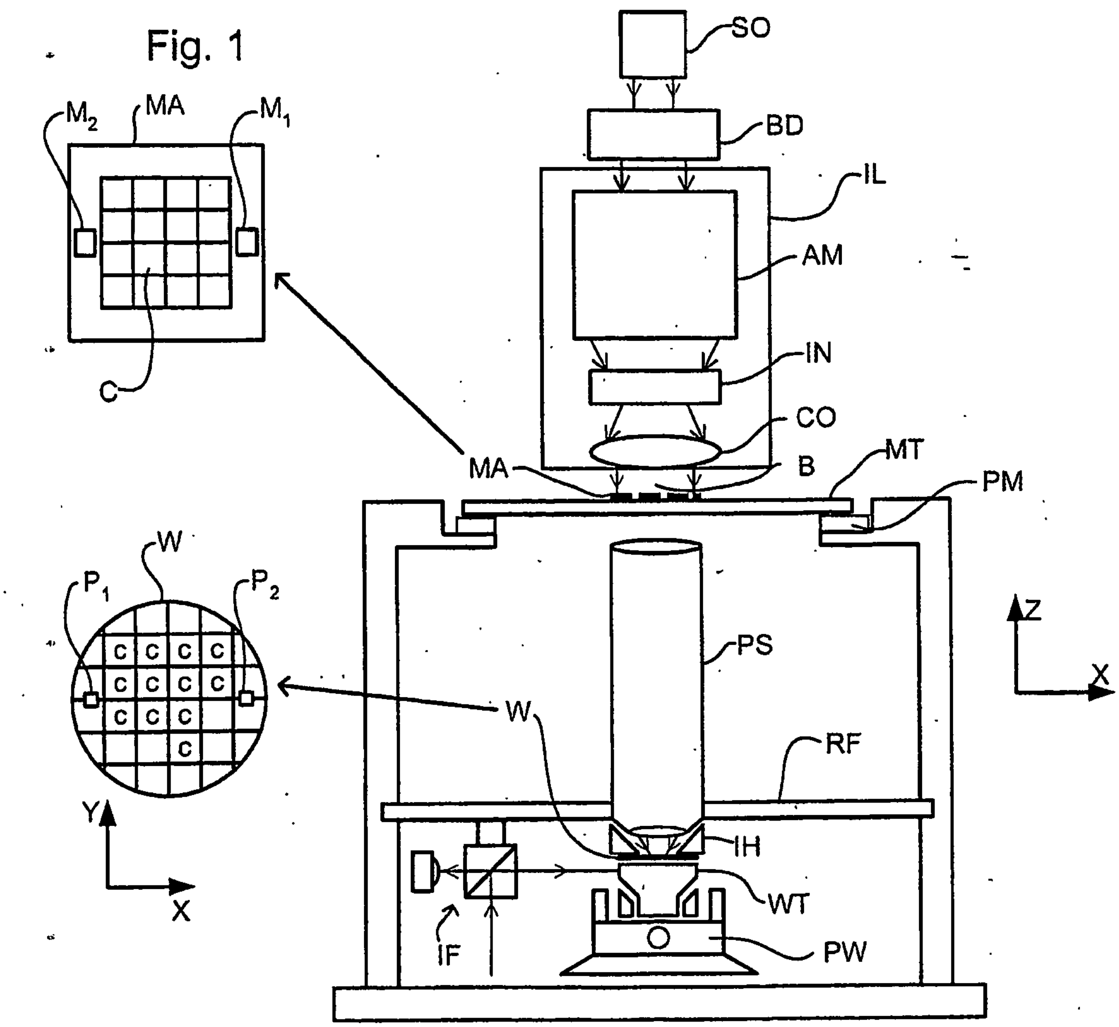


Fig. 2

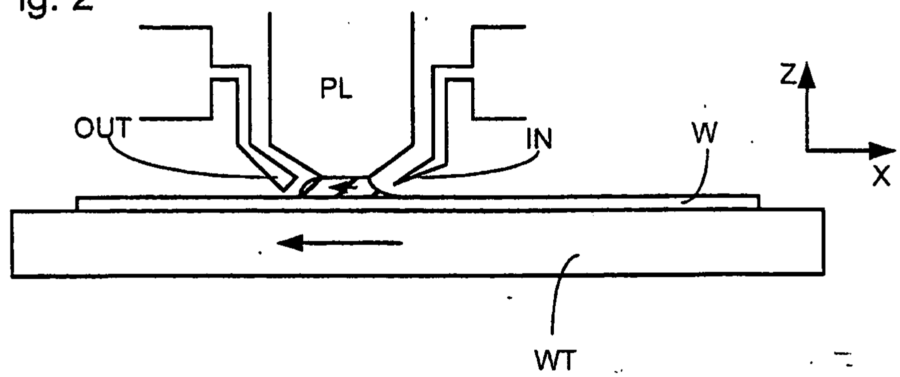


Fig. 3

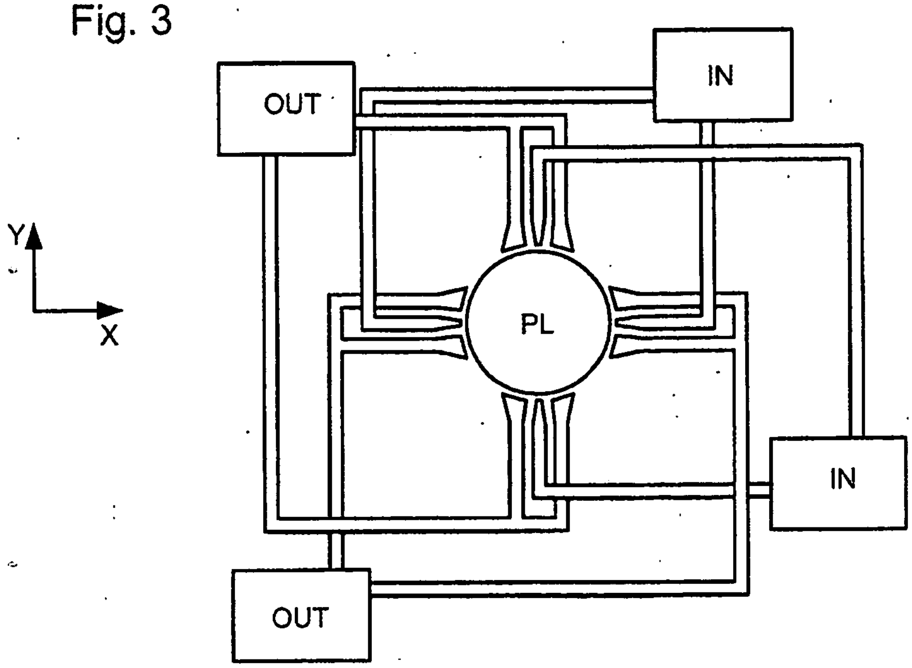


Fig. 4

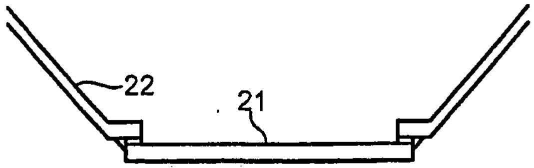


Fig. 5

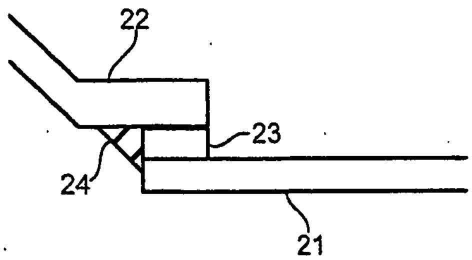


Fig. 6

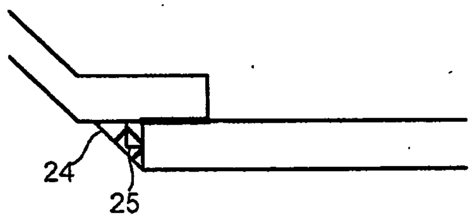


Fig. 7

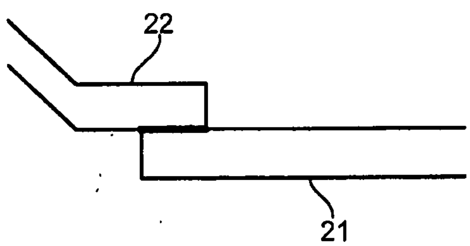


Fig. 8

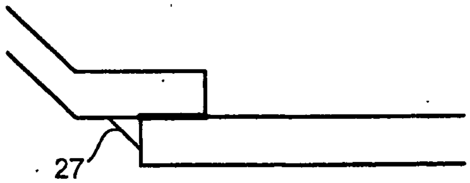


Fig. 9

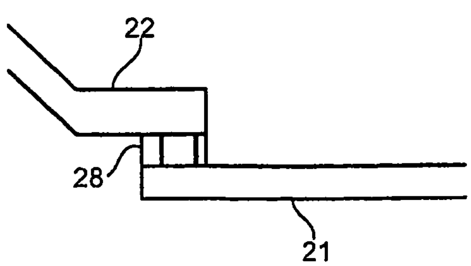
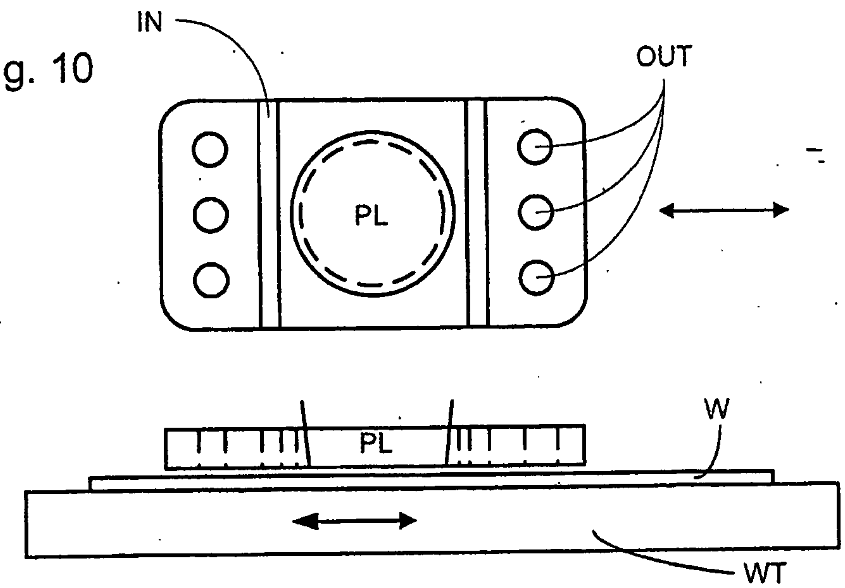


Fig. 10



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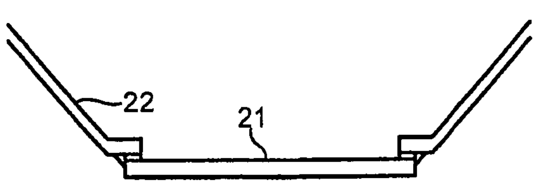
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LITHOGRAPHIC APPARATUS AND DEVICE MANUFACTURING METHOD



(57) Abstract: The joint between the lens (21) and its support (22) comprises an inorganic layer or a direct bond and is thus liquid tight which prevents deformation by the immersion liquid. The joint can be made either warm or cold. Solders, glue, and glue protection can all be used in the formation of this joint. The lens (21) and its support (22) are preferably made of quartz.

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 6 417 974 B1 (SCHUSTER KARL-HEINZ) 9 July 2002 (2002-07-09) abstract figures 1,6 column 1, line 6 - line 10 column 1, line 28 - line 40 column 3, line 22 - column 4, line 3 -----	1-16
X	US 5 610 683 A (TAKAHASHI ET AL) 11 March 1997 (1997-03-11) abstract figures 1,2 column 1, line 10 - line 14 column 4, line 55 - line 60 column 5, line 45 - line 54 -----	1-4,8, 14-16

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Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Andersen, O

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